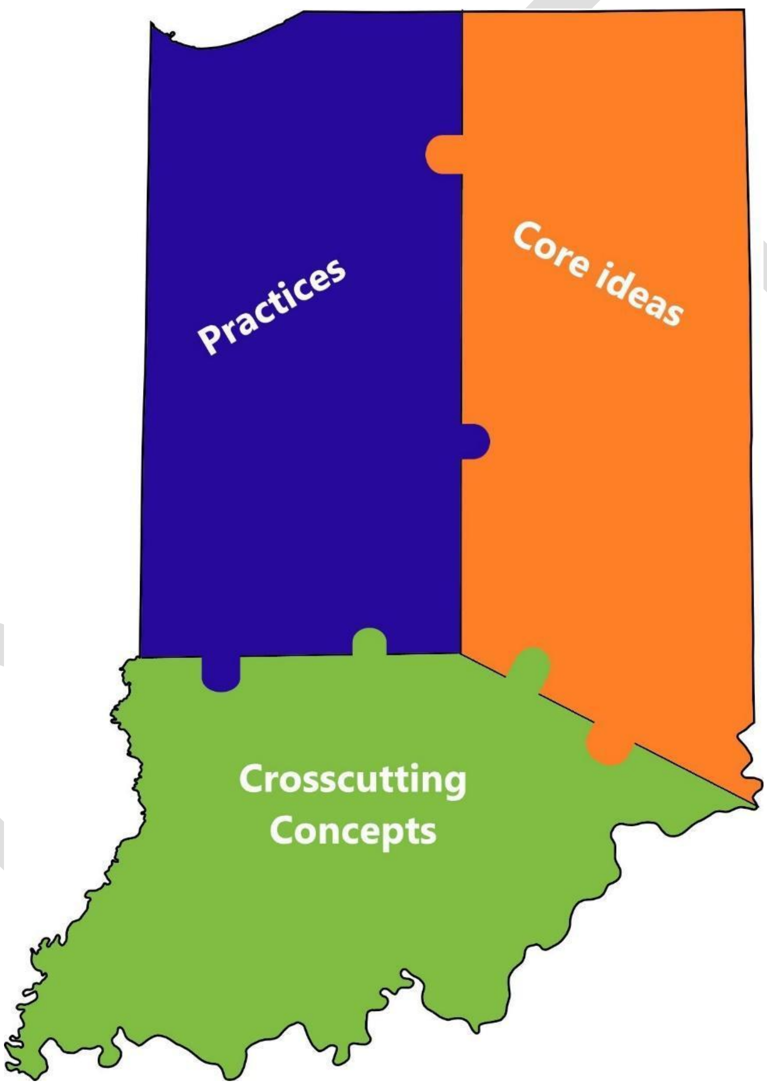
Indiana Academic Standards

Science



Grade Kindergarten

K-12 Science Indiana Academic Standards Overview

The K-12 Science Indiana Academic Standards are based on *A Framework for K-12 Science Education* (NRC 2012) and are meant to reflect a new vision for science education. The following conceptual shifts reflect what is new about these science standards. The K-12 Science Indiana Academic Standards

- reflect science as it is practiced and experienced in the real world,
- build logically from Kindergarten through Grade 12,
- focus on deeper understanding as well as application of content,
- integrate practices, crosscutting concepts, and core ideas.

The K-12 Science Indiana Academic Standards outline the knowledge and science and engineering practices that all students should learn by the end of high school. The standards are three-dimensional because each student performance expectation engages students at the nexus of the following three dimensions:

- Dimension 1 describes scientific and engineering practices.
- Dimension 2 describes crosscutting concepts, overarching science concepts that apply across science disciplines.
- Dimension 3 describes core ideas in the science disciplines.

Science and Engineering Practices

The eight practices describe what scientists use to investigate and build models and theories of the world around them or that engineers use as they build and design systems. The practices are essential for all students to learn and are as follows:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Crosscutting Concepts

The seven crosscutting concepts bridge disciplinary boundaries and unit core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas, and develop a coherent, and scientifically based view of the world. The seven crosscutting concepts are as follows:

1. *Patterns*- Observed patterns of forms and events guide organization and classification, and prompt questions about relationships and the factors that influence them.
2. *Cause and effect- Mechanism and explanation*. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

3. *Scale, proportion, and quantity*- In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
4. *Systems and system models*- Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.
5. *Energy and matter: Flows, cycles, and conservation*- Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
6. *Structure and function*- The way in which an object or living thing is shaped and its substructure determines many of its properties and functions.
7. *Stability and change*- For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Disciplinary Core Ideas
The disciplinary core ideas describe the content that occurs at each grade or course. The K-12 Science Indiana Academic Standards focus on a limited number of core ideas in science and engineering both within and across the disciplines and are built on the notion of learning as a developmental progression. The Disciplinary Core Ideas are grouped into the following domains:

- Physical Science (PS)
- Life Science (LS)
- Earth and Space Science (ESS)
- Engineering, Technology and Applications of Science (ETS)

The K-12 Science Indiana Academic Standards are not intended to be used as curriculum. Instead, the standards are the minimum that students should know and be able to do. Therefore, teachers should continue to differentiate for the needs of their students by adding depth and additional rigor.

Why use the Framework for K12 Science Education as the basis for the revision of science Indiana Academic Standards?

- The framework and standards are based on a rich and growing body of research on teaching and learning in science, as well as on nearly two decades of efforts to define foundational knowledge and skills for K-12 science and engineering.
- Studies show that even young children are naturally inquisitive and much more capable of abstract reasoning than previously thought. This means we can introduce elements of inquiry and explanation much earlier in the curriculum to help them develop deeper understanding.
- The new standards aim to eliminate the practice of “teaching to the test.” Instead, they shift the focus from merely memorizing scientific facts to actually doing science—so students spend more time posing questions and discovering the answers for themselves.
- Historically, K-12 instruction has encouraged students to master lots of facts that fall under “science” categories, but research shows that engaging in the practices used by scientists and engineers plays a critical role in comprehension. Teaching science as a process of inquiry and explanation helps students think past the subject matter and form a deeper understanding of how science applies broadly to everyday life. This is in alignment with the Indiana Priorities for STEM education.
- These new standards support the research by emphasizing a smaller number of core ideas that students can build on from grade to grade. The more manageable scope allows teachers to weave in practices and concepts common to all scientific disciplines — which better reflects the way students learn.
- It is important that each standard be presented in the 3-dimensional format to reflect its scope and full intent.
- Given that each standard is a performance expectation (what students should know and be able to do), the standards are presented with some accompanying supports including clarification and evidence statements.

How to read the revised Science Indiana Academic Standards

Standard Number	**Title**	The title for a set of performance expectations is not necessarily unique and may be reused at several different grade levels

Students who demonstrate understanding can:

Standard Number **Performance Expectation: A statement that combines practices, core ideas, and crosscutting concepts together to describe how students can show what they have learned** [Clarification Statement: A statement that supplies examples or additional clarification to the performance expectation.]

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Activities that scientists and engineers engage in to either understand the world or solve the problem. There are 8 practices. These are integrated into each standard. They were previously found at the beginning of each grade level content standard and known as SEPs. **Connections to the Nature of Science** Connections are listed in either practices or the crosscutting concepts section.	Concepts in science and engineering that have broad importance within and across disciplines as well as relevance in people's lives To be considered core, the ideas should meet at least two of the following criteria and ideally all four: • Have broad importance across multiple sciences or engineering disciplines or be a key organizing concept of a single discipline; • Provide a key tool for understanding or investigating more complex ideas and solving problems; • Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge; • Be teachable and learnable over multiple grades at increasing levels of depth and sophistication. Disciplinary ideas are grouped in four domains: the physical sciences; the life sciences; the earth and space sciences; and engineering, technology and applications of science.	Seven ideas such as Patterns and Cause and Effect, which are not specific to any one discipline but cut across them all. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. **Connections to Engineering, Technology and Applications of Science** These connections are drawn from either the Disciplinary Core Ideas and Science and Engineering Practices.

Evidence Statements	
1	Evidence Statements provide educators with additional detail on what students should know and be able to do.
2	The evidence statements can be used to inform the scaffolding of instruction and the development of assessments.

K-PS2-1 Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

K-PS2-1. **Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.** [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.]

Science and Engineering Practices

Planning and Carrying Out Investigations

Scientists and engineers are constructing and performing investigations in the field or laboratory, working collaboratively as well as individually. Researching analogous problems in order to gain insight into possible solutions allows them to make conjectures about the form and meaning of the solution. A plan to a solution pathway is developed prior to constructing and performing investigations. Constructing investigations systematically encompasses identified variables and parameters generating quality data. While performing, scientists and engineers monitor and record progress. After performing, they evaluate to make changes to modify and repeat the investigation if necessary.

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- With guidance, plan and conduct an investigation in collaboration with peers.

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Connections to the Nature of Science

Scientific Investigations Use a Variety of Methods

- Scientists use different ways to study the world.

Disciplinary Core Ideas

PS2.A: Forces and Motion

- Pushes and pulls can have different strengths and directions.
- Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.

PS2.B: Types of Interactions

- When objects touch or collide, they push on one another and can change motion.

PS3.C: Relationship Between Energy and Forces

- A bigger push or pull makes things speed up or slow down more quickly. *(secondary)*

Crosscutting Concepts

Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Observable features of the student performance by the end of the grade:		
1	Identifying the phenomenon to be investigated	
	a	With guidance, students collaboratively identify the phenomenon under investigation, which includes the following idea: the effect caused by different strengths and directions of pushes and pulls on the motion of an object.
	b	With guidance, students collaboratively identify the purpose of the investigation, which includes gathering evidence to support or refute student ideas about causes of the phenomenon by comparing the effects of different strengths of pushes and pulls on the motion of an object.
2	Identifying the evidence to address this purpose of the investigation	
	a	With guidance, students collaboratively develop an investigation plan to investigate the relationship between the strength and direction of pushes and pulls and the motion of an object (i.e., qualitative measures or expressions of strength and direction; (e.g., harder, softer, descriptions* of “which way”).
	b	Students describe* how the observations they make connect to the purpose of the investigation, including how the observations of the effects on object motion allow causal relationships between pushes and pulls and object motion to be determined

	c	Students predict the effect of the push of pull on the motion of the object, based on prior experiences.
3	Planning the investigation	
	a	In the collaboratively developed investigation plan, students describe*:
		i. The object whose motion will be investigated.
		ii. What will be in contact with the object to cause the push or pull.
		iii. The relative strengths of the push or pull that will be applied to the object to start or stop its motion or change its speed.
		iv. The relative directions of the push or pull that will be applied to the object.
		v. How the motion of the object will be observed and recorded.
		vi. How the push or pull will be applied to vary strength or direction.
4	Collecting the data	
	a	According to the investigation plan they developed, and with guidance, students collaboratively make observations that would allow them to compare the effect on the motion of the object caused by changes in the strength or direction of the pushes and pulls and record their data.

K-PS2-2 Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

K-PS2-2. **Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.** [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.]

Science and Engineering Practices

Analyzing and Interpreting Data

Investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists and engineers use a range of tools to identify the significant features in the data. They identify sources of error in the investigations and calculate the degree of certainty in the results. Advances in science and engineering makes analysis of proposed solutions more efficient and effective. They analyze their results by continually asking themselves questions; possible questions may be, but are not limited to: "Does this make sense?" "Could my results be duplicated?" and/or "Does the design solve the problem with the given constraints?"

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Analyze data from tests of an object or tool to determine if it works as intended.

Disciplinary Core Ideas

PS2.A: Forces and Motion

- Pushes and pulls can have different strengths and directions.
- Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.

ETS1.A: Defining Engineering Problems

- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. *(secondary)*

Crosscutting Concepts

Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Observable features of the student performance by the end of the grade:		
1	Organizing data	
	a	With guidance, students organize given information using graphical or visual displays (e.g., pictures, pictographs, drawings, written observations, tables, charts). The given information students organize includes:
		i. The relative speed or direction of the object before a push or pull is applied (i.e., qualitative measures and expressions of speed and direction; (e.g., faster, slower, descriptions* of "which way").
		ii. The relative speed or direction of the object after a push or pull is applied.
		iii. How the relative strength of a push or pull affects the speed or direction of an object (i.e., qualitative measures or expressions of strength; (e.g., harder, softer).
2	Identifying relationships	
	a	Using their organization of the given information, students describe* relative changes in the speed or direction of the object caused by pushes or pulls from the design solution.
3	Interpreting data	
	a	Students describe* the goal of the design solution.

	b	Students describe* their ideas about how the push or pull from the design solution causes the change in the object's motion.
	c	Based on the relationships they observed in the data, students describe* whether the push or pull from the design solution causes the intended change in speed or direction of motion of the object.

K-PS3-1 Energy

Students who demonstrate understanding can:

K-PS3-1. **Make observations to determine the effect of sunlight on Earth's surface.** [Clarification Statement: Examples of Earth's surface could include sand, soil, rocks, and water.]

Science and Engineering Practices

Planning and Carrying Out Investigations

Scientists and engineers are constructing and performing investigations in the field or laboratory, working collaboratively as well as individually. Researching analogous problems in order to gain insight into possible solutions allows them to make conjectures about the form and meaning of the solution. A plan to a solution pathway is developed prior to constructing and performing investigations. Constructing investigations systematically encompasses identified variables and parameters generating quality data. While performing, scientists and engineers monitor and record progress. After performing, they evaluate to make changes to modify and repeat the investigation if necessary.

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Make observations (firsthand or from media) to collect data that can be used to make comparisons.

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Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Scientists use different ways to study the world.

Disciplinary Core Ideas

PS3.B: Conservation of Energy and Energy Transfer

- Sunlight warms Earth's surface.

Crosscutting Concepts

Cause and Effect

- Events have causes that generate observable patterns.

Observable features of the student performance by the end of the grade:

1	Identifying the phenomenon to be investigated	
	a	From the given investigation plan, students describe* (with guidance) the phenomenon under investigation, which includes the following idea: sunlight warms the Earth's surface.
	b	Students describe* (with guidance) the purpose of the investigation, which includes determining the effect of sunlight on Earth materials by identifying patterns of relative warmth of materials in sunlight and shade (e.g., sand, soil, rocks, water).
2	Identifying the evidence to address the purpose of the investigation	
	a	Based on the given investigation plan, students describe* (with guidance) the evidence that will result from the investigation, including observations of the relative warmth of materials in the presence and absence of sunlight (i.e., qualitative measures of temperature; (e.g., hotter, warmer, colder).
	b	Students describe* how the observations they make connect to the purpose of the investigation.
3	Planning the investigation	
	a	Based on the given investigation plan, students describe* (with guidance):
		i. The materials on the Earth's surface to be investigated (e.g., dirt, sand, rocks, water, grass).

		ii. How the relative warmth of the materials will be observed and recorded.
4	Collecting the data	
	a	According to the given investigation plan and with guidance, students collect and record data that will allow them to:
		i. Compare the warmth of Earth materials placed in sunlight and the same Earth materials placed in shade.
		ii. Identify patterns of relative warmth of materials in sunlight and in shade (i.e., qualitative measures of temperature; e.g., hotter, warmer, colder).
		iii. Describe* that sunlight warms the Earth's surface.

K-PS3-2 Energy

Students who demonstrate understanding can:

K-PS3-2. **Use tools and materials provided to design and build a structure that will reduce the warming effect of sunlight on an area.*** [Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun.]

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Scientists and engineers use their results from the investigation in constructing descriptions and explanations, citing the interpretation of data, connecting the investigation to how the natural and designed world(s) work. They construct or design logical coherent explanations or solutions of phenomena that incorporate their understanding of science and/or engineering or a model that represents it, and are consistent with the available evidence.

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem.

Disciplinary Core Ideas

PS3.B: Conservation of Energy and Energy Transfer

- Sunlight warms Earth's surface.

Crosscutting Concepts

Cause and Effect

- Events have causes that generate observable patterns.

Observable features of the student performance by the end of the grade:		
1	Using scientific knowledge to generate design solutions	
	a	Students use given scientific information about sunlight's warming effect on the Earth's surface to collaboratively design and build a structure that reduces warming caused by the sun.
	b	With support, students individually describe*:
		i. The problem.
		ii. The design solution.
		iii. In what way the design solution uses the given scientific information.
2	Describing* specific features of the design solution, including quantification when appropriate	
	a	Students describe* that the structure is expected to reduce warming for a designated area by providing shade.
	b	Students use only the given materials and tools when building the structure.
3	Evaluating potential solutions	
	a	Students describe* whether the structure meets the expectations in terms of cause (structure blocks sunlight) and effect (less warming of the surface).

K-LS1-1 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]

Science and Engineering Practices

Analyzing and Interpreting Data

Investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists and engineers use a range of tools to identify the significant features in the data. They identify sources of error in the investigations and calculate the degree of certainty in the results. Advances in science and engineering makes analysis of proposed solutions more efficient and effective. They analyze their results by continually asking themselves questions; possible questions may be, but are not limited to: "Does this make sense?" "Could my results be duplicated?" and/or "Does the design solve the problem with the given constraints?"

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.

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Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world.

Disciplinary Core Ideas

LS1.C: Organization for Matter and Energy Flow in Organisms

- All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

Crosscutting Concepts

Patterns

- Patterns in the natural and human designed world can be observed and used as evidence.

Observable features of the student performance by the end of the grade:			
1	Organizing data		
	a	With guidance, students organize the given data from observations (firsthand or from media) using graphical displays (e.g., pictures, charts), including:	
		i.	Different types of animals (including humans).
		ii.	Data about the foods different animals eat.
		iii.	Data about animals drinking water.
		iv.	Data about plants' need for water (e.g., observations of the effects on plants in a classroom or school when they are not watered, observations of natural areas that are very dry).
		v.	Data about plants' need for light (e.g., observations of the effect on plants in a classroom when they are kept in the dark for a long time; observations about the presence or absence of plants in very dark places, such as under rocks or porches).
2	Identifying relationships		
	a	Students identify patterns in the organized data, including that:	
		i.	All animals eat food.

		1. Some animals eat plants.
		1. Some animals eat other animals.
		1. Some animals eat both plants and animals.
		1. No animals do not eat food.
		ii. All animals drink water.
		iii. Plants cannot live or grow if there is no water.
		iv. Plants cannot live or grow if there is no light.
3	Interpreting data	
	a	Students describe* that the patterns they identified in the data provide evidence that:
		i.Plants need light and water to live and grow.
		ii. Animals need food and water to live and grow.
		iii. Animals get their food from plants, other animals, or both.

K-ESS2-1 Earth's Systems

Students who demonstrate understanding can:

K-ESS2-1. **Use and share observations of local weather conditions to describe patterns over time.** [Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.]

Science and Engineering Practices

Analyzing and Interpreting Data

Investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists and engineers use a range of tools to identify the significant features in the data. They identify sources of error in the investigations and calculate the degree of certainty in the results. Advances in science and engineering makes analysis of proposed solutions more efficient and effective. They analyze their results by continually asking themselves questions; possible questions may be, but are not limited to: “Does this make sense?” "Could my results be duplicated?" and/or “Does the design solve the problem with the given constraints?”

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.

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Connections to Nature of Science

Science Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world.

Disciplinary Core Ideas

ESS2.D: Weather and Climate

- Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.

Crosscutting Concepts

Patterns

- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

Observable features of the student performance by the end of the grade:		
1	Organizing data	
	a	With guidance, students organize data from given observations (firsthand or from media) about local weather conditions using graphical displays (e.g., pictures, charts). The weather condition data include:
		i. The number of sunny, cloudy, rainy, windy, cool, or warm days.
		ii. The relative temperature at various times of the day (e.g., cooler in the morning, warmer during the day, cooler at night).
2	Identifying relationships	
	a	Students identify and describe* patterns in the organized data, including:
		i. The relative number of days of different types of weather conditions in a month.
		ii. The change in the relative temperature over the course of a day.
3	Interpreting data	
	a	Students describe* and share that:

		Certain months have more days of some kinds of weather than do other months (e.g., some months have more hot days, some have more rainy days).
		The differences in relative temperature over the course of a day (e.g., between early morning and the afternoon, between one day and another) are directly related to the time of day.

K-ESS2-2 Earth's Systems

Students who demonstrate understanding can:

K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. [Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digging in the ground to hide its food and tree roots can break concrete.]

Science and Engineering Practices

Engaging in Argument from Evidence

Scientists and engineers use reasoning and argument based on evidence to identify the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation, the process by which evidence-based conclusions and solutions are reached, to listen to, compare, and evaluate competing ideas and methods based on merits. Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims.

Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).

- Construct an argument with evidence to support a claim.

Disciplinary Core Ideas

ESS2.E: Biogeology

- Plants and animals can change their environment.

ESS3.C: Human Impacts on Earth Systems

- Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. *(secondary)*

Crosscutting Concepts

Systems and System Models

- Systems in the natural and designed world have parts that work together.

Observable features of the student performance by the end of the grade:		
1	Supported claims	
	a	Students make a claim to be supported about a phenomenon. In their claim, students include the idea that plants and animals (including humans) can change the environment to meet their needs.
2	Identifying scientific evidence	
	a	Students identify and describe* the given evidence to support the claim, including:
		i. Examples of plants changing their environments (e.g., plant roots lifting sidewalks).
		ii. Examples of animals (including humans) changing their environments (e.g., ants building an ant hill, humans clearing land to build houses, birds building a nest, squirrels digging holes to hide food).
		iii. Examples of plant and animal needs (e.g., shelter, food, room to grow).
3	Evaluating and critiquing evidence	
	a	Students describe* how the examples do or do not support the claim.
4	Reasoning and synthesis	
	a	Students support the claim and present an argument by logically connecting various needs of plants and animals to evidence about how plants/animals change their environments to meet their needs. Students include:
		i. Examples of how plants affect other parts of their systems by changing their environments to meet their needs (e.g., roots push soil aside as they grow to better absorb water).

		ii.	Examples of how animals affect other parts of their systems by changing their environments to meet their needs (e.g., ants, birds, rabbits, and humans use natural materials to build shelter; some animals store food for winter).

K-ESS3-1 Earth and Human Activity

Students who demonstrate understanding can:

K-ESS3-1. **Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.** [Clarification Statement: Examples of relationships could include that deer eat buds and leaves; therefore, they usually live in forested areas; and, grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system.]

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models A practice of both science and engineering is to use and construct conceptual models that illustrate ideas and explanations. Models are used to develop questions, predictions and explanations; analyze and identify flaws in systems; build and revise scientific explanations and proposed engineered systems; and communicate ideas. Measurements and observations are used to revise and improve models and designs. Models include, but are not limited to: diagrams, drawings, physical replicas, mathematical representations, analogies, and other technological models. Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, storyboard) that represent concrete events or design solutions. ● Use a model to represent relationships in the natural world.	**ESS3.A: Natural Resources** ● Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.	**Systems and System Models** ● Systems in the natural and designed world have parts that work together.

Observable features of the student performance by the end of the grade:			
1	Components of the model		
	a	From the given model (e.g., representation, diagram, drawing, physical replica, diorama, dramatization, storyboard) of a phenomenon involving the needs of living things and their environments, students identify and describe* the components that are relevant to their representations, including:	
		i.	Different plants and animals (including humans).
		ii.	The places where the different plants and animals live.
		iii.	The things that plants and animals need (e.g., water, air, and land resources such as wood, soil, and rocks).
2	Relationships		
	a	Students use the given model to represent and describe* relationships between the components, including:	
		i.	The relationships between the different plants and animals and the materials they need to survive (e.g., fish need water to swim, deer need buds and leaves to eat, plants need water and sunlight to grow).
		ii.	The relationships between places where different plants and animals live and the resources those places provide.

		iii.	The relationships between specific plants and animals and where they live (e.g., fish live in water environments, deer live in forests where there are buds and leaves, rabbits live in fields and woods where there is grass to eat and space for burrows for homes, plants live in sunny and moist areas, humans get resources from nature [e.g., building materials from trees to help them live where they want to live]).
3	Connections		
	a	Students use the given model to represent and describe*, including:	
		i.	Students use the given model to describe* the pattern of how the needs of different plants and animals are met by the various places in which they live (e.g., plants need sunlight so they are found in places that have sunlight; fish swim in water so they live in lakes, rivers, ponds, and oceans; deer eat buds and leaves so they live in the forest).
		ii.	Students use the given model to describe* that plants and animals, the places in which they live, and the resources found in those places are each part of a system, and that these parts of systems work together and allow living things to meet their needs.

K-ESS3-2 Earth and Human Activity

Students who demonstrate understanding can:

K-ESS3-2. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.* [Clarification Statement: Emphasis is on local forms of severe weather.]

Science and Engineering Practices

Asking Questions and Defining Problems

A practice of science is posing and refining questions that lead to descriptions and explanations of how the natural and designed world(s) work and these questions can be scientifically tested. Engineering questions clarify problems to determine criteria for possible solutions and identify constraints to solve problems about the designed world.

Asking questions and defining problems in grades K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.

- Ask questions based on observations to find more information about the designed world.

Obtaining, Evaluating, and Communicating Information

Scientists and engineers need to be communicating clearly and articulating the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations, as well as, orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs.

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world.

Disciplinary Core Ideas

ESS3.B: Natural Hazards

- Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events.

ETS1.A: Defining and Delimiting an Engineering Problem

- Asking questions, making observations, and gathering information are helpful in thinking about problems. *(secondary)*

Crosscutting Concepts

Cause and Effect

- Events have causes that generate observable patterns.

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Connections to Engineering,Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- People encounter questions about the natural world every day.

Influence of Engineering, Technology, and Science on Society and the Natural World

- People depend on various technologies in their lives; human life would be very different without technology.

Observable features of the student performance by the end of the grade:			
1	Addressing phenomena of the natural world		
	a	Students formulate questions about local severe weather, the answers to which would clarify how weather forecasting can help people avoid the most serious impacts of severe weather events.	
2	Identifying the scientific nature of the question		
	a	Students' questions are based on their observations.	
3	Obtaining information		
	a	Students collect information (e.g., from questions, grade appropriate texts, media) about local severe weather warnings (e.g., tornado alerts, hurricane warnings, major thunderstorm warnings, winter storm warnings, severe drought alerts, heat wave alerts), including that:	
		i.	There are patterns related to local severe weather that can be observed (e.g., certain types of severe weather happen more in certain places).
		ii.	Weather patterns (e.g., some events are more likely in certain regions) help scientists predict severe weather before it happens.
		iii.	Severe weather warnings are used to communicate predictions about severe weather.
		iv.	Weather forecasting can help people plan for, and respond to, specific types of local weather (e.g., responses: stay indoors during severe weather, go to cooling centers during heat waves; preparations: evacuate coastal areas before a hurricane, cover windows before storms).

K-ESS3-3 Earth and Human Activity

Students who demonstrate understanding can:

K-ESS3-3. **Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.*** [Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.]

Science and Engineering Practices

Obtaining, Evaluating, and Communicating Information

Scientists and engineers need to be communicating clearly and articulating the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations, as well as, orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs.

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas.

Disciplinary Core Ideas

ESS3.C: Human Impacts on Earth Systems

- Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. *(secondary)*

Crosscutting Concepts

Cause and Effect

- Events have causes that generate observable patterns.

Observable features of the student performance by the end of the grade:

1	Communicating information		
	a	Students use prior experiences and observations to describe* information about:	
		i.	How people affect the land, water, air, and/or other living things in the local environment in positive and negative ways.
		ii.	Solutions that reduce the negative effects of humans on the local environment.
	b	Students communicate information about solutions that reduce the negative effects of humans on the local environment, including:	
		i.	Examples of things that people do to live comfortably and how those things can cause changes to the land, water, air, and/or living things in the local environment.
		ii.	Examples of choices that people can make to reduce negative impacts and the effect those choices have on the local environment.
	b	Students communicate the information about solutions with others in oral and/or written form (which include using models and/or drawings.	

K-2-ETS1-1 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions and Defining Problems A practice of science is posing and refining questions that lead to descriptions and explanations of how the natural and designed world(s) work and these questions can be scientifically tested. Engineering questions clarify problems to determine criteria for possible solutions and identify constraints to solve problems about the designed world. Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions. ● Ask questions based on observations to find more information about the natural and/or designed world(s). ● Define a simple problem that can be solved through the development of a new or improved object or tool.	**ETS1.A: Defining and Delimiting Engineering Problems** ● A situation that people want to change or create can be approached as a problem to be solved through engineering. ● Asking questions, making observations, and gathering information are helpful in thinking about problems. ● Before beginning to design a solution, it is important to clearly understand the problem.	

Observable features of the student performance by the end of the grade:			
1	Addressing phenomena of the natural or designed world		
	a	Students ask questions and make observations to gather information about a situation that people want to change. Students' questions, observations, and information gathering are focused on:	
		i.	A given situation that people wish to change.
		ii.	Why people want the situation to change.
		iii.	The desired outcome of changing the situation.
2	Identifying the scientific nature of the question		
	a	Students' questions are based on observations and information gathered about scientific phenomena that are important to the situation.	
3	Identifying the problem to be solved		
	a	Students use the information they have gathered, including the answers to their questions, observations they have made, and scientific information, to describe* the situation people want to change in terms of a simple problem that can be solved with the development of a new or improved object or tool.	
4	Defining the features of the solution		
	a	With guidance, students describe* the desired features of the tool or object that would solve the problem, based on scientific information, materials available, and potential related benefits to people and other living things.	

K-2-ETS1-2 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Science and Engineering Practices

Developing and Using Models

A practice of both science and engineering is to use and construct conceptual models that illustrate ideas and explanations. Models are used to develop questions, predictions and explanations; analyze and identify flaws in systems; build and revise scientific explanations and proposed engineered systems; and communicate ideas. Measurements and observations are used to revise and improve models and designs. Models include, but are not limited to: diagrams, drawings, physical replicas, mathematical representations, analogies, and other technological models.

Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a simple model based on evidence to represent a proposed object or tool.

Disciplinary Core Ideas

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem’s solutions to other people.

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

Observable features of the student performance by the end of the grade:			
1	Components of the model		
	a	Students develop a representation of an object and the problem it is intended to solve. In their representation, students include the following components:	
		i.	The object.
		ii.	The relevant shape(s) of the object.
		iii.	The function of the object.
	b	Students use sketches, drawings, or physical models to convey their representations.	
2	Relationships		
	a	Students identify relationships between the components in their representation, including:	
		i.	The shape(s) of the object and the object’s function.
		ii.	The object and the problem it is designed to solve.
3	Connections		
	a	Students use their representation (simple sketch, drawing, or physical model) to communicate the connections between the shape(s) of an object, and how the object could solve the problem.	

K-2-ETS1-3 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyze data from tests of an object or tool to determine if it works as intended. Investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists and engineers use a range of tools to identify the significant features in the data. They identify sources of error in the investigations and calculate the degree of certainty in the results. Advances in science and engineering makes analysis of proposed solutions more efficient and effective. They analyze their results by continually asking themselves questions; possible questions may be, but are not limited to: “Does this make sense?” "Could my results be duplicated?" and/or “Does the design solve the problem with the given constraints?” Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.	**ETS1.C: Optimizing the Design Solution** • Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	

Observable features of the student performance by the end of the grade:			
1	Organizing data		
	a	With guidance, students use graphical displays (e.g., tables, pictographs, line plots) to organize given data from tests of two objects, including data about the features and relative performance of each solution.	
2	Identifying relationships		
	a	Students use their organization of the data to find patterns in the data, including:	
		i.	How each of the objects performed, relative to:
			1. The other object.
			2. The intended performance.
		ii.	How various features (e.g., shape, thickness) of the objects relate to their performance (e.g., speed, strength).
3	Interpreting data		
	a	Students use the patterns they found in object performance to describe*:	
		i.	The way (e.g., physical process, qualities of the solution) each object will solve the problem.
		ii.	The strengths and weaknesses of each design.
		iii.	Which object is better suited to the desired function, if both solve the problem.